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TESTING KUZNETS' HYPOTHESIS FOR RUSSIAN REGIONS: TRENDS AND INTERPRETATIONS [1]

The paper established a number of "stylized facts", one of which is a confirmation of the S. Kuznets' hypothesis of the nonlinear dependence between the degree of inequality in income distribution and welfare economic systems on the example of a group of Russian regions for the period 2002–2012. It is shown that, for a given sample, the welfare and economic growth factors amplify their influence on inequality in income distribution in the post-crisis period. The monotonous growth of income inequality which was observed before the crisis of 2008 is slowing in the process of raising the per capita gross regional product (GRP) during the post-crisis period, and for the foreseeable future, in some regions, its direction can be reversed, while maintaining a trend of socio-economic development. Despite the persistence over time of a convex nature of S. Kuznets' curve for Russian regional data, its parameters changed during the reporting 2002–2012 period. The maximum point of the curve shifts to the left, its convexity increases. These facts indicate that the income inequality growth of the Russian regions' as a result of growth of per capita GRP is slowing. For some regions in the post-crisis period, the income inequality does not grow with the growth of per capita GRP, or it even reduces. This fact can be attributed to the implementation of the Russian federal socially oriented projects and programs in recent years. The results can be used for the development of regional economic policy in order to regulate the level of income distribution inequality in the regions of Russia.

Keywords: inequality of income distribution, economic growth, Gini coefficient, competitiveness of regions, regression modeling, gross regional product, income, post-crisis period, regional policy, poverty reduction

1. Introduction

Inequality of income distribution over time has recently returned to prominence in economic development. A number of scientists have directly linked income inequality and economic growth, see, for example, Barro [1, 2]. This paper confirms several hypotheses related to income inequality. In particular, the Kuznets' hypothesis [3] about the nonlinear dependence between the level of inequality and wealth in economic systems is verified using the data of 79 Russian regions for the period 2002–2012.

In present work, the assumption of homogeneity of the mechanism of mutual influence of income inequality and economic development in the Russian regions is done and verified. This assumption allows considering a relatively short time periods in the simulation in the presence of a large sample of spatial observations. Initially, we keep the main explanatory variable and the mechanism of constructing a model in accordance with the original formal characteristics of the Kuznets' model, but we modified the object of study and a combination of factors that affect income inequality in the regions of Russia.

Getting a stable, well-specified econometric model of the Kuznets' curve permits to predict soundly the level and dynamics of income inequality in the Russian regions, depending on their level of wealth. The aim of this study is not the attempt to verify the effect of the level of income inequality separate, very important factors, such as migration, employment and so forth. This is a subject for future research.

2. Literature review

In 1955, based on the analysis of empirical data of the major developed countries in the nineteenth century and the first half of the twentieth century, Kuznets [3] suggested a specific nonlinear dynamic process relating the level of inequality in income distribution to the growth process. He found that in the process of growth the level of inequality grows first up to a certain point and then decreases, which is now called an inverted U curve. In order to demonstrate this hypothesis, he presented a model of a two-sector economy. He identified the agricultural and non-agricultural

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sectors (labeled *A* and *B*, respectively), which differed by the level and structure of income. He hypothesized that economic development occurred with the non-agricultural sector expanding and agricultural sector narrowing. On the basis of abstract data, Kuznets then traced the change in inequality in population incomes when the agricultural sector (*A*) share of total output changed from 0.8 to 0.2. To assess the impact of various structural parameters on the shape of the curve characterizing the dynamics of inequality, Kuznets considered several models with different values of key parameters. As a result, he was able to demonstrate that changes in its parameters affected the shape of the income distribution curve (in particular, its maximum point) but not its general character (or the inverted *U* curve).

The simulation results obtained by Kuznets have a simple mathematical interpretation. The test indicator (in this case, the level of income inequality), is affected by several (two or more) factors: an increase in some factors reduces this level and an increase in the others increases it. Additionally, the effect of the former (latter) factors increased (reduced) over time due to the structural changes in the economic system. The maximum point of the curve describes a structure of the economic system in which the total effect of the factors that increase inequality becomes weaker than the overall impact of the other factors.

A mathematical formalization of the process described in Kuznets [3] is provided in the Anand and Kanbur study [4, 5]. Their model highlights the structural components of the overall level of inequality, an in-sector component (a monotonically increasing curve), and a trans-sector component (inverted *U*-shaped curve).

All of the above leads to a number of preliminary conclusions:

1. Kuznets' hypothesis is based on the assumption and rationale of the impact of structural reforms and the development of economic systems on the level of inequality in income distribution.

2. A non-linear character of the curve of the dynamics of inequality (inverted "*U*" curve) is determined by the changes of various factors in the process of structural transformation. The shape of the curve can also change over time.

3. Kuznets' hypothesis has been confirmed for any economic system (country, region), the group of economic systems, in any period of time, during which there are structural transformations.

The Kuznets' work provides a basis for the analysis of the nonlinear dependence of the income inequality and the welfare on the economic system. However, there is no econometric modeling based on these results in the aforementioned Kuznets' paper.

2.1. Econometric modeling for Kuznets' hypothesis testing

Ahluwalia [6, 7] was among the first to test Kuznets' hypothesis econometrically. He used the share of income of all groups in the country distributed by income quintiles as indicators of income inequality (or the same indicators as in Kuznets [3]). The log of per capita GDP was used to indicate the level of welfare of the country. Some other work testing Kuznets' hypothesis do not use the share of income of certain groups of the population as the dependent variable, instead using the Gini coefficient [8, 9] as the measure of inequality of income distribution; see, for example, Papanek and Kyn [10] and Huang [11]. Other alternative measurements of inequality are also known [12, 13].

In general, these works can be divided into two groups: ones that follow Ahluwalia [10, 11] and use the logarithm of per capita GDP as an independent variable in their models [10]), and others who did not [11]). Despite the similarity of the two approaches, their respective mathematical models and the corresponding interpretations are quite different.

2.2. Regional aspect and Russian domestic studies

Most of the works of the early period were devoted to defining the relationship between income distribution and economic growth using data from the countries [4, 5, 6, 7, 10, 14, 15]. In recent years, income distribution on economic growth in developing countries [16] is under the focus of the evaluation.

It is obvious that the country context is still causing a lot of criticism regarding significant differences in the process of income data collection [17, p. 26, 18, p. 196], as well as because of the inability to identify the specifics of each country [19, p. 60]. The necessity of the regional analysis is reflected in the work by M. Partridge [20, p. 1021], which states that the distribution of income is originally different for each country of the World.

Table 1 shows the results of Kuznets' hypothesis testing based on US regional data. It should be noted that most studies, presented in Table 1, primarily use panel data.

It is noted also that results greatly vary, due to the use of different time periods, different models specifications and methods. In addition, a large number of confirmation of the hypothesis of a *U*-shaped curve instead of an inverted "*U*" curve was the basis for further improvement of the mod-

Table 1

Kuznets hypothesis testing on US regional data

Research by	Model specification	Method	Time period	Shape of the curve confirmed
O. M. Amos [25]	M. Ahluwalia [6, 7]	Pooled cross-sectional OLS	1950–1980	Income inequality rises after confirming inverted "*U*"-shape curve, possibility of "*S*"-shape curve
R. Ram [26, 27]	M. Ahluwalia [6, 7]	Cross-sectional OLS	1949, 1959, 1969, 1979	"*U*"-shape confirmed
A. K. Fosu [28]	M. Ahluwalia [6, 7]; comments to R. Ram [26]	Cross-sectional OLS	1949, 1959, 1969, 1979	Inverted "*U*"-shape
YU Hsing and D. J. Smyth [29]	M. Ahluwalia [6, 7]	Seemingly Unrelated Regression with auto-regression components	1948–1987	Substantial confirmation of "*U*"-shape confirmed
W. Levernier et al [30]	M. Ahluwalia [6, 7]	Cross-sectional OLS	1960–1990	Unconfirmed
P. W. E. Jacobsen and D. E. A. Giles [31]	M. Ahluwalia [6, 7]; YU. Hsing и D. J. Smyth [29]	Seemingly Unrelated Regression; Co-integration	1947–1991	"*U*"-shape confirmed in a post-war period (from 1947)
R. Tribble [22, 23]	M. Ahluwalia [6, 7]; R. Tribble [23]	OLS	1947–1990	"*S*"-shape confirmed
Mushinski [24]	M. Ahluwalia [6, 7]	OLS	1990	Inverted "*U*"-shape and mixed results after inclusion of forth order polynomial component
C. A. Gallet и R. M. Gallet [32]	M. Ahluwalia [6, 7]; R. Tribble [22, 23]; third order polynomial components according to J. List and C. Gallet [21];	OLS, with regime change according to K. Ohtani et al [33]	1947–1998; 1947–1987	Switch from inverted "*U*"-shape on "*U*"-shape after inclusion variable of racial differences in income inequality
S. Naghshpour [34]	M. Ahluwalia [6, 7]; third order polynomial components	OLS	1947–2000	Unconfirmed
D. Kim et al [35]	M. Ahluwalia [6, 7]	Dynamic OLS with fixed effects; Mean group estimator [36][33]; Pooled mean group estimator [37]	1945–2004	"*U*"-shape confirmed
O. C. Dincer and B. Gunalp [38]	M. Ahluwalia [6, 7]	System-GMM [39, 40]	1981 to 1997	"*U*"-shape confirmed
Huang et al [41]	M. Ahluwalia [6, 7]	Dynamic OLS with fixed effects; Mean group estimator [36][33]; Pooled mean group estimator [37] Controlling for growth volatility [42, 43]	1945–2004	"*U*"-shape confirmed

els specification, by integrating the third order component [21–23] and fourth order component [24] in the original specification.

Several papers devoted to the testing and assessment opportunities for the application of the Kuznets' hypothesis for Russian regional data have been made in recent years by Russian scientists. A brief review of them is submitted in the article by Ratnikova and Furmanov [44].

From an econometric point of view, one should mention the Demidova's findings [45], in which the Kuznets' hypothesis received confirmation on panel data for 84 regions of Russia during the period 2001–2006. The funds coefficient is used as a

dependent variable characterizing the level of inequality, and she considered the real average income per capita as the major independent variable. Ratnikova and Fourmanov, referring to the results obtained by Demidova, pay attention to the instability of the model constructed by Demidova; that is, the regression results are significantly modified by the exclusion of Moscow city data of the number of observations of the model.

The analysis of the current economic and demographic situation using the structural decomposition of inequality into normal and redundant components is performed by A.Y. Shevyakova, A.J. Kiruta [46]. Their findings contradict the current view of the inequality as an inevitable but temporary side effect of economic growth.

The authors argue that economic growth favors the growth of a normal inequality[1], whereas excessive inequality generated by numerous factors, including institutional, does not decrease during the period of economic growth and needs the long-term and various adjustments. In particular, the A.Y. Sheviakov and A.J. Kiruta showed that the canonical Kuznets' hypothesis, estimated for the Russian regions, is not confirmed. However, it becomes correct with a high degree of statistical significance, if the index of overall inequality would be replaced with the index of normal inequality in it.

Moreover, a number of macroeconomic indicators are positively correlated with normal inequality and negatively correlated with the excessive one. Such an effect is, as noted by the authors, can not be detected using traditional indicator of overall inequality. In addition, the authors found that the most powerful factor in explaining macroeconomic differences between the regions of Russia was the difference between normal and excessive inequality levels.

An important achievement of A.Y. Novikov and A.J. Kiruta is also a study of the effect of income inequality on migration in the Russian regions.

M.Y. Malkina confirmed the existence of the negative effect of the level of economic development on the uniformity of income in regions of the Russian Federation at the present stage (due to the fact that most of them are found on the upstream stage of the Kuznets' curve) [47]. In addition, the review of the works of Russian scientists presented the M.Y. Malkina is also noteworthy.

In the paper by I.P. Glazyrina and I.A. Klevakina [48], it was also concluded that for the majority of regions the real GDP per capita increase corresponds to the *Gini* coefficient rising, that is, they are on the ascending branch of the Kuznets' curve, and only Moscow and Khanty-Mansiysky Autonomus District[2] have overcome the peak of the Kuznets curve and passed on the descending branch of the curve [48, p. 117–121].

G.P. Litvintseva, O.V. Voronkova and E.A. Stukalenko [12] proposed and tested approach to benchmarking regional incomes based on the relative cost of a fixed basket of goods and services in the region to the cost of the same set in the Russian Federation.

In the same paper, the calculation of Gini coefficients taking into account social transfers in kind for groups of regions was made. The authors concluded that this refinement decreased interregional differentiation in Russia.

On the basis of summarizing the results of previous publications tested the Kuznets' hypothesis, in current work, we tested it for Russian regional data for the 2002–2012 period.

3. Specification

We estimate the following equations [10, 11]:

$$Gini = \alpha + \beta \log\left(PCG\right) + \gamma(\log\left(PCG\right))^2 + \delta D + \varepsilon, \quad (1)$$

$$Gini = \alpha + \beta \widetilde{PCG} + \gamma \widetilde{PCG}^2 + \delta D + \varepsilon, \quad (2)$$

where *Gini* is the annual regional *Gini* coefficient; *PCG* is per capita gross regional product adjusted for annual price indexes ("top wave" variable selection refers to the division of this variable on 1 000 000 for illustrative purposes of simulation results); *D* is a vector of dummy variables (not included when both space and time fixed effects are used at the same time); and α, β, γ, δ (vector) and ε are coefficients and the error of the regression, respectively. We chose such stochastic equations based on the fact that they are most common in the economic literature for testing Kuznets' hypothesis.

4. Data description

We use the data of Federal State Statistics Service of Russian Federation (Rosstat). The following variables are used:

— PCG denotes the gross regional product per capita, adjusted for the annual price index. GRP per capita data were obtained from on the official website of Rosstat[3] in the national accounts sec-

[1] Please refer to description of notion on normal inequality [46, p. 5, 23].

[2] Khanty-Mansiysk autonomous district is the subject of Russian Federation, but officially and in this study is accounted as a part of the Tyumen Oblast.

[3] The official website of the Federal State Statistics Service of the Russian Federation. Retrieved from: www.gks.ru.

Table 2

Regression results using equation (1)

Model number	Dependent variable: Gini — Regional Gini coefficient							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Beginning of the period	2002	2002	2002	2002	2002	2002	2009	2009
End of the period	2006	2006	2006	2012	2012	2012	2012	2012
Cross-section fixed effects	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Period fixed effects	No	No	No	No	Yes	No	No	No
C	1.3068 (0)	0.1337 (0.6140)	–0.2008 (0.1773)	–0.4205 (0)	–0.3708 (0)	–0.3682 (0)	–0.9445 (0)	–0,9083 (0)
Log (PCG)	–0.2056 (0)	0.0159 (0.7416)	0.0793 (0.0034)	0.1149 (0)	0.1036 (0)	0.1049 (0)	0,2113 (0)	0,2154 (0)
(Log (PCG))2	0.0109 (0)	0.0004 (0.8438)	–0.0025 (0.0388)	–0.0039 (0)	–0.0033 (0)	–0.0034 (0)	–0,0083 (0)	–0,0089 (0)
d (Moscow)		0.1876 (0)						
d (Tyumen)		0,0385 (0.0072)						
d_2008						0,0047 (0,0005)		
d_2011						–0,0059 (0.0001)		
d_2012								0,0065 (0)
R-squared	0.3953	0.6348	0.9536	0.9093	0.9182	0.9131	0.9698	0,9762
Prob(F-statistic)	0	0	0	0	0	0	0	0

Notes: "0" — indicates 0,0000; the probabilities of confirming null hypothesis for t-statistics (p-value) are presented in parentheses; d (Moscow), d (Tyumen), d_2008, d_2011, d_2012 are dummy variables for the city of Moscow, Tyumen region of Russian Federation, and for 2008, 2011, 2012, respectively.

tion. Price index[1] was used as a deflator to adjust the GRP obtained from "Regions of Russia. Socio-Economic Indicators" periodicals located on the same site;

— Gini denotes Gini coefficient[2] taken as an indicator of differentiation of income distribution in the region. This ratio was also obtained from "Regions of Russia. Socio-Economic Indicators." It is worth noting that the *Gini* index for 2001 is not available for the year 2002, which means that we cannot do a full comparison of our results with the models of Demidova [45] and Ratnikova and Fourmanov [44]. The use of composite data from other sources indicates a substantial difference in the method of calculation and, as a consequence, the deterioration of the simulation results. In addition, we follow the classical works testing the Kuznets' hypothesis [6, 7, 10, 11].

We work with panel data including all regions of Russia, except for the Chechen Republic, as well as regions that were included in the larger subjects of Russian Federation in the process of creating larger regions. The number of regions in the sample after this adjustment was 79. Regression modeling covers the period between 2002 and 2012.

5. Regression and simulation results

We first estimate Kuznets' hypothesis using equation (1). The regression results are presented in Table 2.

Anticipating the analysis of simulation results, it should be noted that a relatively short time period does not create econometric problems in panel data regression analysis due to the large number of spatial observations in the panel. In addition, a large number of observations of the panel also allows observing Kuznets' curve in the relatively short periods due to the fact that Russian regional data are much more homogeneous than

[1] We assume that the use of adjustments for price index (Consumer Price Index) is appropriate as a substitute for the GDP deflator for the transformation of nominal GDP to real.

[2] The method of calculating the *Gini* coefficient is fixed in Goskomstat Regulation (Decree of State Statistical Committee of Russian Federation 16.07.1996 №61 "On approving the methods of calculating the monetary income and expenses of the population and the main social-economic indicators of the living standard).

Table 3

Regression results extending Model 6 of Table 2

Dependent variable: Gini	Sample: 2002–2012	Cross section observations: 79		
Explanatory variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	–0.325362	0.072307	–4.499732	0.0000
Log (PCG)	0.101048	0.012523	8.069113	0.0000
(Log (PCG))2	–0.003436	0.000543	–6.328477	0.0000
D_2002	–0.007005	0.001828	–3.832210	0.0001
D_2004	–0.003482	0.001547	–2.250003	0.0247
D_2005	–0.007107	0.001471	–4.832735	0.0000
D_2006	–0.004809	0.001407	–3.418923	0.0007
D_2007	0.002642	0.001377	1.919124	0.0553
D_2008	0.003788	0.001368	2.768492	0.0058
D_2011	–0.005447	0.001439	–3.784209	0.0002
R-squared	0.9178			
Probability (F-statistic)	0.000000			

Note: Cross-section fixed effects are used, with panel least squares estimation.

the data of different countries, which are considered in the classical Kuznets model.

Therefore, we made the assumption of homogeneity of the mechanism of mutual influence of income inequality and economic development in the Russian regions, similarly to Partridge's paper [20, p. 1021], who analyzed states of the USA. Thus, the present study largely follows the original Kuznets model: explained variable of the model and the mechanism of model building are preserved. However, the object of study and a set of factors to be included in the model are modified.

In Model 1 we do not use fixed effects, and the estimation is for the period 2002–2006. It can be characterized by a relatively low degree of explaining the difference of the dependent variable (39.5 %) and instability. In Model 2, several dummy variables are added (d(Moscow), d(Tyumen)). This specification led to the outcome where the coefficients at all the key explanatory variables became insignificant (see Model 2).

This fact, to a certain extent, is in agreement with the result obtained by Ratnikova and Furmanov [44]. However, when using the method of least squares for panel data with spatial fixed effects (Model 3), the specification improves, and the results confirm the Kuznets' hypothesis.

Further expansion of the data for the period 2002–2012 also improves the model specification and its stability significantly for all types of fixed effects used (Models 4, 5, 6). The Kuznets' hypothesis is fully confirmed for these specifications. Also, using temporary dummy variables allows us to track the impact of the crisis on the relationship (Model 6).

Table 1 clearly manifests the influence of the crisis of 2008: the sign of the coefficient at the dummy variable d_2008 is positive and statistically significant, whereas for other periods (2002, 2004–2006, 2011) the sign of the relevant coefficient is negative. All aforementioned dummies are highly significant; the significance of dummy variables for 2002, 2004–2006 is shown in the modeling results presented in Table 3. The crisis of 2008 gives a small but pronounced effect on the stochastic equation describing the Kuznets' curve for Russian regional data.

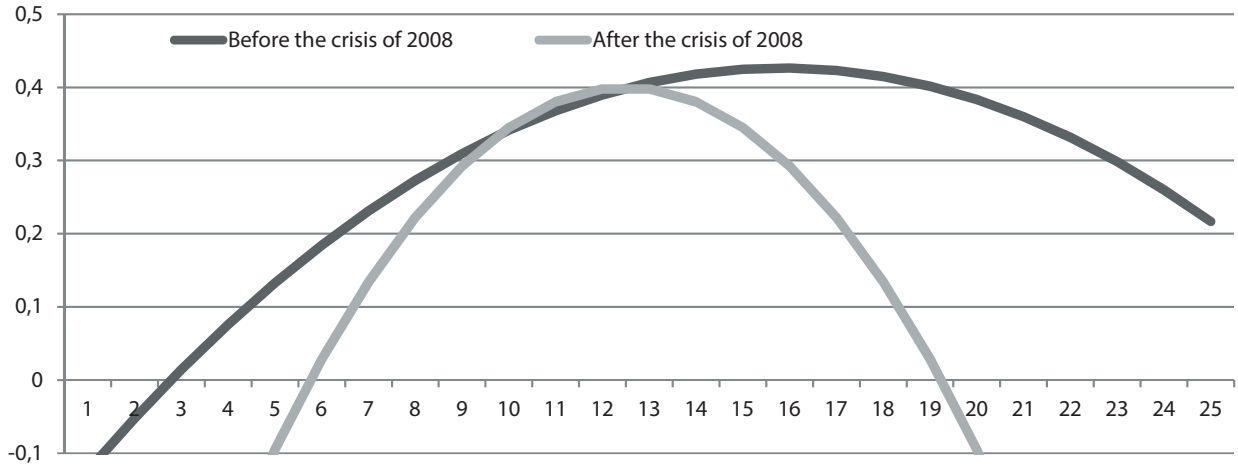
Models 7 and 8 in Table 2 are built on a sample of post-crisis period of 2009–2012. Along with the stability of these models we again observe the confirmation of the Kuznets' hypothesis. However, the form of stochastic dependence is different from the form generated by the sample 2002–2012 period (Models 4–6 in Table 1) and for the sample 2002–2006 (Model 1–3 in Table 2).

In order to study the dynamics of changes in the shape of the Kuznets' curve for Russian regions in the 21st century, we construct such curves on panels 2002–2006 (or before the crisis, using Model 3 of Table 2) and for the period of 2009–2012 (or after the crisis, using Model 7 of Table 2). See Figure 1.

According to Figure 1, it can be seen that as the maximum point of the curve shifts to the left (turning point), the curve becomes less flat (more concave). It is important to note that the value of the variable Log (PCG) for Russian regions (or the variable that is an argument for the constructed curves in Figure 1) varies in the interval 9;13 in a given time period.

Figure 1 suggests the following conclusions:

1. There is an increase in the influence factors of welfare and economic growth on inequality in



Note: The ordinate of the graph corresponds to the Gini coefficient, where the abscissa is Log (PCG).

Fig. 1. *Comparing the Kuznets' curve for Russian regions before and after the crisis*

Table 4

Regression results using equation (2)

Dependent variable: Gini	Sample: 2002–2012	Cross section observations: 79		
Explanatory variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.380432	0.002065	184.1864	0.0000
PCG/1000000	0.001963	0.017477	0.112294	0.9106
(PCG/1000000)2	–0.031240	0.012672	–2.465358	0.0139
R-squared	0.914291			
Probability (F-statistic)	0.000001			

Note: Cross-section fixed effects are used, with panel least squares estimation.

income distribution in the post-crisis period in Russia.

2. In the post-crisis period, the trend in the monotonous growth of income inequality in the process of raising the per capita GRP is slowing, and in the foreseeable future, its direction can be reversed, at least for some Russian regions, while maintaining a trend of socio-economic development.

If instead we use equation (2), the Kuznets' hypothesis for the period 2002–2012 is also confirmed. See Table 4.

It should be noted that the model presented in Table 4 is constructed by using both spatial and temporal fixed effects.

6. Conclusion

Our main result is a confirmation of the Kuznets' hypothesis for Russian regions in the period 2002–2012. In addition, we find strong support for the Kuznets' hypothesis for several periods of time (e.g., before the crisis of 2008 and in the post-crisis period), and also for different explanatory variables (e.g., with the logarithm of per capita gross regional product and without it).

Despite the persistence over time of the concave nature of the Kuznets' curve for Russian regional data, its parameters apparently changed during the 2002–2012 years. Over time, we find that the maximum point of the curve has shifted to the left, and its concavity has increased. These results indicate, that the growth of inequality in income distribution in the Russian regions by GRP per capita growth is getting slower. For some Russian regions in the post-crisis period, income inequality does not seem to grow with the growth of GRP, and in fact, inequality tends to fall, perhaps because of the implementation of the Russian federal socially oriented projects and programs in Russia in recent years. These results also indicate the possible impact of factors affecting the level of differentiation of income in the region, indicating either that an acceleration of structural reforms in the Russian economy in the post-crisis period is taking place, or that the impact of factors driving income inequality has changed over recent time.

One of the areas of future research will be developing a generalized Kuznets' model, in order to test the feasibility of introducing additional factors, which may have potentially significant impact on the level of income differentiation (such as labor migration flows, unemployment, etc.).

References

1. Barro, R. J. (2000). Inequality and Growth in a Panel of Countries. *Journal of Economic Growth, 5(1),* 5–32.

2. Barro, R. J. (1996). *Determinants of Economic Growth: A Cross-Country Empirical Study* (No. w5698). National Bureau of Economic Research, 118.

3. Kuznets, S. (1955). Economic Growth and Income Inequality. *The American Economic Review, 45(1),* 1–28.

4. Anand, S. & Kanbur, S. R. (1993). The Kuznets Process and the Inequality —Development Relationship. *Journal of Development Economics, 40(1),* 25–52.

5. Anand, S. & Kanbur, S. R. (1993). Inequality and Development. A critique. *Journal of Development Economics, 41(1),* 19–43.

6. Ahluwalia, M. S. (1976). Inequality, Poverty and Development. *Journal of Development Economics, 3(4),* 307–342.

7. Ahluwalia, M. S. (1976). Income Distribution and Development: Some Stylized Facts. *The American Economic Review,* 128–135.

8. Ceriani, L. & Verme, P. (2012). The Origins of the Gini Index: Extracts from Variabilità e Mutabilità (1912) by Corrado Gini. *The Journal of Economic Inequality, 10(3),* 421–443.

9. Gini, C. (1912). Variabilita e Mutabilita, Contributo Allo Studio Delle Distribuzioni: Relazione Statische. *Studi Economico-Giuridici Della R.* Universita Di Cagliari.

10. Papanek, G. F. & Kyn, O. (1986). The Effect on Income Distribution of Development, the Growth Rate and Economic Strategy. *Journal of Development Economics, 23(1),* 55–65.

11. Huang, H.-C. R. (2004). A Flexible Nonlinear Inference to the Kuznets Hypothesis. *Economics Letters, 84(2),* 289–296.

12. Litvintseva, G. P., Voronkova, O. V. & Stukalenko, E. A. (2007). Regionalnoye neravenstvo dokhodov i uroven bednosti naseleniya Rossii: analiz s uchetom pokupatelnoy sposobnosti rublya [Regional inequality of the income and level of poverty of the population of Russia: the analysis taking into account purchasing power of ruble]. *Problemy prognozirovaniya [Problems of Forecasting], 6,* 119–131.

13. Cowell, F. A. (2000). Measurement of Inequality. *Handbook of Income Distribution.* Atkinson A. B., Bourguignon F., 87–166.

14. Li, H., Xie, D. & Zou H.-f. (2000). Dynamics of Income Distribution. *Canadian Journal of Economics,* 937–961.

15. Ram, R. (1988). Economic Development and Income Inequality: Further Evidence on the U-Curve Hypothesis. *World Development, 16(11),* 1371–1376.

16. MacDonald, R. & Majeed, M. T. (2010). Distributional and Consequences of Globalization: A Dynamic Comparative Analysis for Developing Countries.

17. Panizza, U. (2002). Income Inequality and Economic Growth: Evidence from American Data. *Journal of Economic Growth, 7(1),* 25–41.

18. Rooth, D. O. & Stenberg, A. (2012). The Shape of the Income Distribution and Economic Growth–Evidence from Swedish Labor Market Regions. *Scottish Journal of Political Economy, 59(2),* 196–223.

19. Williamson, J. G. (1991). British Inequality During the Industrial Revolution: Accounting for the Kuznets Curve. *Income Distribution in Historical Perspective.* Brenner Y. S. et al. Cambridge University Press, 261.

20. Partridge, M. D. (1997). Is Inequality Harmful for Growth? Comment. *The American Economic Review,* 1019–1032.

21. List, J. A. & Gallet, C. A. (1999). The Kuznets Curve: What Happens After the Inverted-U? *Review of Development Economics, 3(2),* 200–206.

22. Tribble, R. (1996). The Kuznets-Lewis Process within the Context of Race and Class in the US Economy. *International Advances in Economic Research, 2(2),* 151–164.

23. Tribble, R. (1999). A Restatement of the S-Curve Hypothesis. *Review of Development Economics, 3(2),* 207–214.

24. Mushinski, D. W. (2001). Using Non-Parametrics to Inform Parametric Tests of Kuznets' Hypothesis. *Applied Economics Letters, 8(2),* 77–79.

25. Amos, O. M. (1988). Unbalanced Regional Growth and Regional Income Inequality in The Latter Stages of Development. *Regional Science and Urban Economics, 18(4),* 549–566.

26. Ram, R. (1991). Kuznets's Inverted-U Hypothesis: Evidence from a Highly Developed Country. *Southern Economic Journal,* 1112–1123.

27. Ram, R. (1993). Kuznets's Inverted-U Hypothesis: Reply. *Southern Economic Journal,* 528–532.

28. Fosu, A. K. (1993). Kuznets's Inverted-U Hypothesis: Comment. *Southern Economic Journal,* 523–527.

29. Hsing, Y. & Smyth, D. J. (1994). Kuznets's Inverted-U Hypothesis Revisited. *Applied Economics Letters, 1(7),* 111–113.

30. Levernier, W., Rickman, D. S. & Partridge, M. D. (1995). Variation in US State Income Inequality: 1960–1990. *International Regional Science Review,18(3),* 355–378.

31. Jacobsen, P. W. & Giles, D. E. (1998). Income Distribution in the United States: Kuznets' Inverted-U Hypothesis and Data Non-Stationarity. *Journal of International Trade & Economic Development, 7(4),* 405–423.

32. Gallet, C. A. & Gallet, R. M. (2004). US Growth and Income Inequality: Evidence of Racial Differences. *The Social Science Journal, 41(1),* 43–51.

33. Ohtani, K., Kakimoto, S. & Abe, K. (1990). A Gradual Switching Regression Model with a Flexible Transition Path. *Economics Letters, 32(1),* 43–48.

34. Naghshpour, S. (2005). The Cyclical Nature of Family Income Distribution in the United States: An Empirical Note. *Journal of Economics and Finance, 29(1),* 138–143.

35. Kim, D. H., Huang, H. C. & Lin, S. C. (2011). Kuznets Hypothesis in a Panel of States. *Contemporary Economic Policy, 29(2),* 250–260.

36. Pesaran, M. H. & Smith, R. (1995). Estimating Long-Run Relationships from Dynamic Heterogeneous Panels. *Journal of Econometrics, 68(1),* 79–113.

37. Pesaran, M. H., Shin, Y. & Smith, R. P. (1999). Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. *Journal of the American Statistical Association, 94(466),* 621–634.

38. Dincer, O. C. & Gunalp, B. (2012). Corruption and Income Inequality in the United States. *Contemporary Economic Policy, 30(2),* 283–292.

39. Arellano, M. & Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error-Components Models. *Journal of Econometrics, 68(1),* 29–51.

40. Blundell, R. & Bond, S. (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics, 87(1),* 115–143.

41. Huang, H.-C. R., Fang, W., Miller, S. M. & Yeh, C.-C. (2015). The Effect of Growth Volatility on Income Inequality. *Economic Modelling, 45,* 212–222.

42. Byrne, J. P. & Davis, E. P. (2005). Investment and Uncertainty in the G7. *Review of World Economics, 141(1),* 1–32.

43. Byrne, J. P. & Philip Davis, E. (2005). The Impact of Short-and Long-run Exchange Rate Uncertainty on Investment: A Panel Study of Industrial Countries. *Oxford Bulletin of Economics and Statistics, 67(3),* 307–329.

44. Ratnikova, T. & Furmanov, K. (2010). *Ekonomicheskiy rost i neravenstvo dokhodov v regionakh Rossii: proverka gipotezy Kuznetsa [Economic growth and inequality of the income in regions of Russia: test of the Kuznets hypothesis]. Sistemnoye modelirovanie sotsialno-ekonomicheskikh protsessov. Mezhdunarodnaya nauchnaya shkola-seminar imeni akademika S. S. Shatalina [System modelling of socio-economic processes. International scientific workshop named after the Academician S. S. Shatalin].* Zvenigorod: Voronezh State University Publ., 275–276.

45. Demidova, O. A. (2008). Proverka gipotezy S. Kuznetsa dlya rossiyskikh regionov [Test of the Kuznets hypothesis for the Russian regions]. *Obozrenie prikladnoy i promyshlennoy matematiki [Review of applied and industrial mathematics], 15(4),* 664–666.

46. Shevyakov, A. Yu. & Kiruta, A. Ya. (2009). *Neravenstvo, ekonomicheskiy rost i demografiya: neissledovannye vzaimosvyazi [Inequality, economic growth and demography: unexplored interrelations].* Moscow: M-Studio Publ., 192.

47. Malkina, M. Yu. (2014). Issledovanie vzaimosvyazi urovnya razvitiya i Stepeni neravenstva dokhodov v regionakh Rossiyskoy Federatsii [Research of interrelation of the level of development and degree of the income inequality in the regions of the Russian Federation]. *Ekonomika regiona [Economy of region], 2,* 238–248.

48. Glazyrina, I. P. & Klevakina, E. A. (2013). Ekonomicheskiy rost i neravenstvo po dokhodam v regionakh Rossii [Economic growth and inequality according to the income in the regions of Russia]. *EKO. Vserossiyskiy ekonomicheskiy zhurnal [ECO. All-Russian economic journal], 11(473),* 113–128.

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